QuikSCAT Survey - September 2002

Introduction

One of the problems encountered in forecasting weather over the oceans is the lack of a dense network of observations of surface wind direction and speed. Since ships tend to avoid areas of inclement weather and the current network of buoys is nowhere near optimal density there is a substantial data void over the ocean areas. The instruments on QuikSCAT can acquire hundreds of times more observations of surface wind speed and direction each day than can ships and buoys. By providing continuous, high-resolution measurements of both wind speed and direction, regardless of weather conditions, QuikSCAT has been able to fill in this data void. Since the data has been incorporated into the National Oceanic and Atmospheric Administration's (NOAA) operational global weather analysis and forecast systems, the forecasters in the Marine Prediction Center(MPC) at The National Centers for Environmental Prediction (NCEP) have near real time access to this data right at their computer workstations. In order to determine the usefulness and the accuracy of QuikSCAT data, the 19 staff forecasters were asked to complete a survey about their use of the QuikSCAT wind product. The questions addressed the source and frequency of use as well as the strengths and weaknesses they observed in the data. The forecasters were also asked to specify how they use the product in their forecast process. Upon analyzing the results of the survey, it became obvious that the use of the QuikSCAT data in the MPC is close to 100%. The source of the data was varied as were the reasons that the forecasters found the data useful. However, important conclusions were drawn from the forecasters' comments leading to valuable recommendations for future use of the QuikSCAT data.

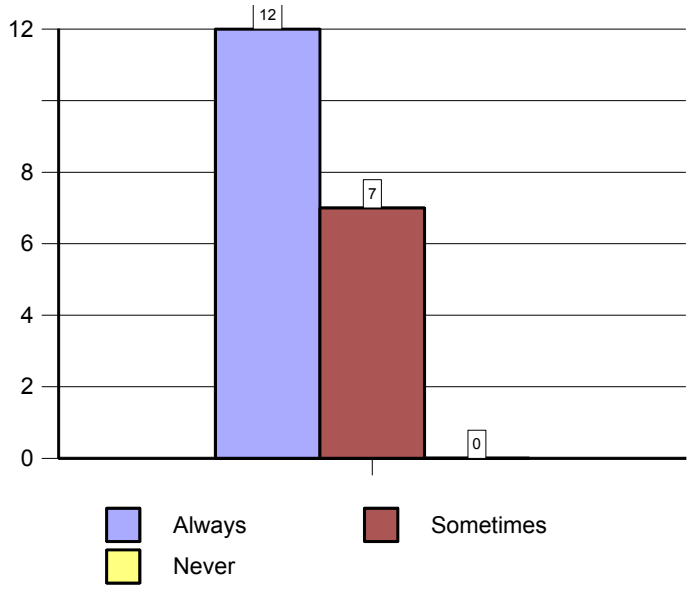
Survey Questions and Results

Question #1. Do you use QuikSCAT winds in your forecast preparation?

100% of the forecasters QuikSCAT in some way in their forecast preparation.

Question #2. How often do you use QuikSCAT winds in your forecast preparation?

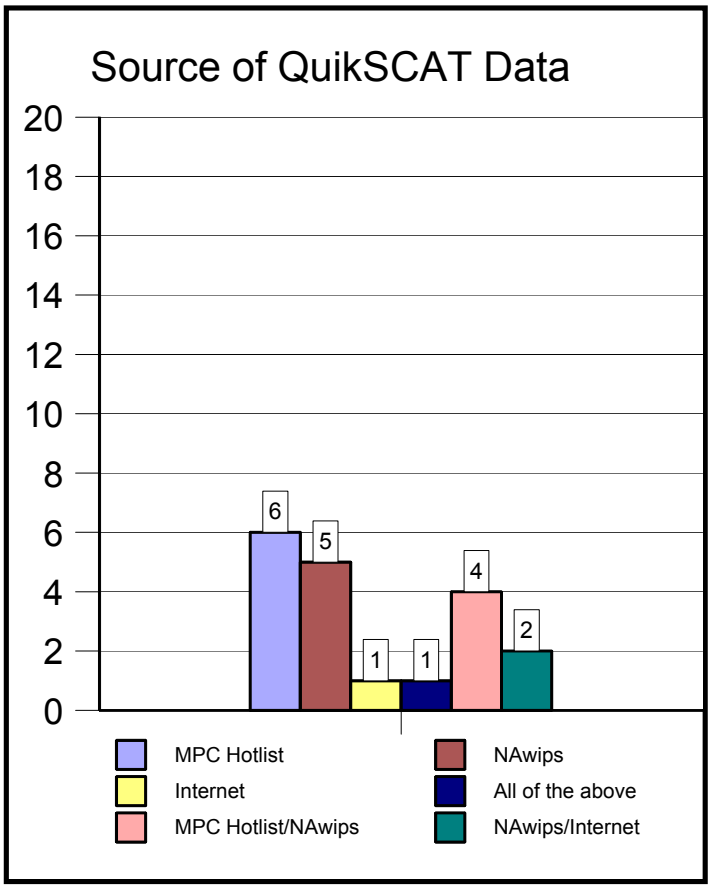
63% of the forecasters always use QuikSCAT in there forecast preparation, while 37% use QuikSCAT sometimes.



Question #3. Where do you get the QuikSCAT wind data from?

Most of the forecasters use the QuikSCAT data from the link on the MPC Hotlist or the gridded data from Nmap2 on NAwips.

QuikSCAT Source	# Forecasters	% Forecasters
MPC Hotlist	6	32%
Internet	1	5 %
NAwips	5	26%
All of the above	1	5%
MPC Hotlist/NAwips	4	21%
Nawips/Internet	2	10%



Question #4. **How do you use QuikSCAT data?**

The uses ranged from locating the centers of highs and lows and the position of fronts to deciding whether or not to issue a Gale or Storm Warning. Below are specific responses.

- Locate centers of highs and lows
- Locate fronts
- Use in areas without ship, buoy or C-MAN reports
- Verify gales, storm force, etc
- Use in areas without other observations
- Determine if a low is gale or storm strength
- Determine strength of wind around lows
- Decide whether to issue a warning or not
- Use with quality control program to verify ship reports
- Verify ship reports with surface analysis
- Use in articles on significant storms in Mariner's Weather Log
- Check wind against model guidance
- Describe initial conditions in the high seas text
- Gauge model initialization
- Verify model forecast to decide which model is best
- Locate areas of 25kt winds for the high seas desk
- Use to find wind speed and direction when doing Pacific Regional Desk
- Use to check on quality control ship observed winds
- Use in association with SSM/I data to locate highs and lows
- Use to produce surface analyses
- Use to determine warnings
- Use to describe initial conditions in high seas text
- Gauge model initialization
- Find highs, lows, fronts, areas of maximum winds associated with various storm and frontal structure

Question # 5. **Do you find the QuikSCAT data useful? Please explain.**

100% of the forecasters found the QuikSCAT data useful in some way.

	17
NO	**0**
SOMEWHAT	**2**

Below are specific responses :

- $ considering how little data is available over the ocean, every little bit helps
- $ sometimes it is our only source of wind observations, but the QuikSCAT wind speeds are usually much too high in areas of precipitations around lows, fronts, etc.
- $ although the data may not align at the exact time it does provide enough data to determine strength of winds
- $ very useful for systems that produce the stronger winds, as ships steer away from the systems.
- $ if you have a data pass in a data spare area it is very useful for your analysis.
- $ the data offers ground truth
- $ provides input over observationally sparse areas. Also provides additional ground truth even when surface obs are available.
- $ marine data is sparse so quikscat fills in the gaps and its reliable
- $ it is a tool in the decision making process
- $ occasionally contradicted by sfc obs. Calls for discretion.
- $ It might show an area of gale or storm force winds where there are no obs.
- $ usually quite accurate- better than buoys or ships. Could use more data and more frequent passes.
- $ extremely useful. The data illustrates the complexity of the boundary layer in the vicinity of strong SST gradients. Also reveals cyclone frontal and wind structure.
- $ In data sparse areas mainly north of 50 N quikscat is vital for producing accurate surface analyses, also in determining warning areas. Models don't always resolve wind maxes near Greenland or in English channel - quikscat is very useful here.
- $ particularly in the vicinity of the gulf stream
- $ helpful for verifying guidance and useful for data sparse waters especially over the pacific offshore waters

$ essential- must have!

Question # 6 **Has QuikSCAT ever been the deciding factor in making a forecast decision? Explain.**

95% of the forecasters have used QuikSCAT data as a deciding factor in making a forecast decision..

YES	**18**
NO	**1**

Below are specific examples:

$ QuikSCAT comes in very handy in data sparse areas when trying to determine of a system is a gale/storm/etc..
$ Gale vs sub-gale; storm vs gale.
$ I use QuikSCAT often for deciding on low strengths in the data sparse areas of both oceans.
$ Frequently is the only data available to help in determining whether to issue a warning.
$ Deciding between gale and storm categories for example, especially when we have just received a new pass of QuikSCAT data. Sometimes use the high resolution 12.5km version as well.
$ When satellite imagery and forecast model output were
$ indicating storm versus gale conditions with little to no actual surface obs.
$ The data many times indicates an area of slightly stronger winds than what observations are showing.
$ When warning criteria conditions are suspected, QuikSCAT data often provides the reason to issue, or not issue, warnings.
$ Gale or no gale warnings, for example
$ speed where no obs available and Is clear that the obs are not corrupted by rain
$ I have put out Gale warnings based on QuikSCAT
$ Determining intensity of systems; sometimes it is the only data available.
$ Have both upgraded and downgraded warnings based on QuikSCAT. After using QuikSCAT for some time have been able to anticipate and forecast warnings near SST gradients where the low levels become unstable. Have also discussed possible tropical storm development with TPC after looking at most recent QuikSCAT pass.
$ Can't remember a time that a forecast decision was based solely on QuikSCAT, but it is always a factor in forecast preparation at some

level.

- $ In areas of colder water temps with warm air over cold water temps do not mix down to the surface
- $ Pushing winds up to gales instead of going 30.
- $ Useful in deciding whether gale or storm warnings are needed over data sparse areas of the Pacific and Atlantic High Seas.
- $ Almost daily in determining the winds associated with lows/fronts in the high seas forecast. Used often to determine if a system is a gale or storm, storm or hurricane force, etc.

Question #7. Do you notice any problems or inaccuracies in the QuikSCAT data?

Most of the problems were noted in areas of precipitation, and along the edges of passed as well as with the availability of the data. Below are specific problems along with forecaster comments.

A. Problems in areas of precipitation

- $ velocities too high in tropical systems
- $ windspeed usually too high in areas of precipitation around lows, fronts, etc.
- $ data should be compared to real observations; many times the data indicates an area of slightly stronger winds than the observations are showing
- $ more data should be rain flagged
- $ rain flagged data also produces the dilemma of what to believe
- $ how to interpret rain -flagged data; can you edit it out?
- $ rain flagged data
- $ data is occasionally contradicted by surface observations; this calls for discretion
- $ areas of precipitation
- $ rain is a problem and can skew the position of tight circulation center along with overestimating winds in heavy rain
- $ rain contamination
- $ hard to determine the effect of the rain

B. Since the satellite is a polar orbiting satellite, this causes problems with data availability and timeliness

- $ data void and length of time between passes sometimes makes the product unusable
- $ only 2 passes over a given area per day
- $ need more satellites
- $ high resolution version not available in the west pacific
- $ not enough passes
- $ current system leaves some gaps in coverage
- $ sensors should be on GOES satellites to provide continuous coverage to all areas
- $ sometimes data is 6-8 hours old
- $ not always timely
- $ could use more frequent passes

- $ timeliness can be a problem
- $ only available every12 hours over a given point
- $ nature of polar orbiting satellite data- not always complete in coverage or timely

C. Data on the edge of pass sometimes inaccurate
- $ data on the edge of a pass is typically in error
- $ boundaries of swath
- $ swath edge can be a problem, but it is easily detectible when it is
- $ wind barbs are often invalid near the edges of data passes
- $ bad data along edges of passes
- $ seems a bit high but not always on the edge of the pass

D. Miscellaneous comments
- $ Winds overdone at times near Ice edges
- $ Not enough resolution for eyewall winds in compact hurricanes.
- $ Need a better explanation of the limits of QuikSCAT data
- $ One gale wind doesn't make a gale
- $ Not always clear what is corrupted data and what isn't
- $ Seems like corrupted data shouldn't even be published
- $ Not clear on dependence on model background field in determining circulation center locations
- $ Occasional box-like appearance of wind fields around lows produces reduced confidence of wind directions and speed
- $ Conflicting data when two passes overlap
- $ Sometimes places tropical centers S/SW of actual center

Question #8. Do you notice any strong points in the data? If so, explain briefly.

- The data makes difficult to locate systems/fronts much more identifiable.
- It's objective where ship data is often subjective.
- It covers data sparse areas.
- Mainly that it fills in the gaps since the oceans have relatively few data points in comparison to land.
- Good for an accurate surface analysis mainly in data spare areas
- Data provides colorful look at small scale features.
- It is a good starting place for surface analysis.
- The data is remarkably accurate when compared to ground truth observations. It is often the only way to determine what conditions are near major synoptic features.
- gives good overall view of wind field.
- reports from surface data sparse areas
- Yes when processed in a timely manner invaluable for initialization of forecasts.
- Hurricane force winds in extra tropical cyclones. Can easily detect well above 65kts.
- can determine mesoscale differences in wind field structure.
- Links oceanic features to PBL
- Since measurement is done same way does not appear to have any geographic bias.
- very useful in northern latitudes- Greenland/Bering Sea
- Superior coverage over SSM/I due to more limited precipitation/liquid cloud contamination.
- Great for locating highs and ridges.
- The data is useful in finding exact locations of occlusions in mature cyclones also determining presence of multiple low center or frontal waves
- Strong points clearly is around the vicinity of well developed oceanic lows and fronts where there are noticeable distinctions in wind speed.
- data does and excellent job of depicting wind speed in a warm advection event over cooler water temps.
- usually good on location of strongest wind fields.

Comments and Recommendations

.1. Comment:. While the data was easy to access, there were some problems noted.

- forecasters were not sure how to interpret rain flagged data
- some needed a better explanation of the limits of the data
- some were not always clear on what data is corrupted and what isn't
- not clear on dependence on model background field in determining circulation center locations

Recommendation 1: A general overview of the QuikSCAT data, along with its limits would greatly benefit the forecasters.

2. Comment: Due to the nature of a polar orbiting satellite, there are not enough passes to provide complete data coverage.

Recommendation: 2A. Sensors should be placed on GOES satellites to provide continuous coverage to all areas.

Recommendation 2B. Need more satellites

Conclusion

Upon analyzing the results of the survey, two points quickly became apparent. One, the QuikSCAT data is being used by all of the MPC forecasters and two, the forecasters want more data passes. Of the 19 MPC forecasters 63% use QuikSCAT winds all the time, while 37% use the winds some of the time The main reason for this was that current data was not always available for a specific time and location when preparing a forecast. This could be solved if more data passes were available. Some were unsure how to interpret the inherent errors in the data (e.g. rain flagged data and data at the edge of the pass.) This could be remedied by providing the forecasters with a short, concise description of the nature of the satellite and how to interpret the errors. Finally, and most importantly the forecasters felt that the data gives a good overview of the wind field, provides data in data sparse areas and gives a colorful look at small-scale features. The use of the QuikSCAT data makes it much easier for them to locate fronts, highs and lows and areas of strong winds. The result is that they are able to make their forecasts and put out warnings with more confidence and accuracy, in a timely manner. Accurate warnings and forecasts ultimately help to protect life and property - an essential part of the mission of the National Weather Service.

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